SVKM's

D. J. Sanghvi College of Engineering

Program: B.Tech in Comp. Sci. and Eng.(Data Science) **Academic Year: 2022** **Duration: 3 hours**

Date: 12.01.2023

Time: 10:30 am to 01:30 pm

Subject: Time Series Analysis (Semester V) **Marks: 75**

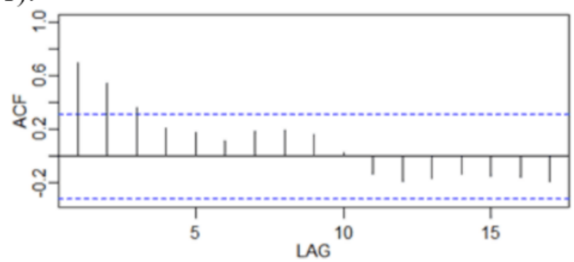
Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

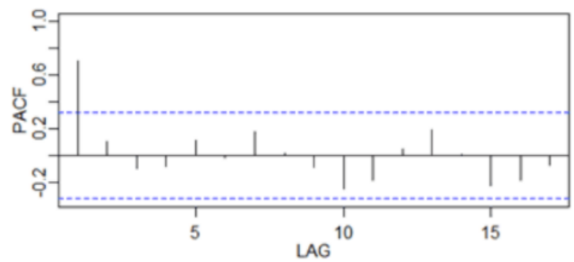
(1) This question paper contains_**02**_pages.
(2) All Questions are Compulsory.
(3) All questions carry equal marks.
(4) Answer to each new question is to be started on a fresh page.
(5) Figures in the brackets on the right indicate full marks.
(6) Assume suitable data wherever required, but justify it.
(7) Draw the neat labelled diagrams, wherever necessary.

<table>
<tr><th>Question No.</th><th></th><th>Max. Marks</th></tr>
<tr><td rowspan="3">Q1 (a)</td><td>i. What do you mean by volatility in time series? Explain in detail the various volatility models used in time series analysis.</td><td>[05]</td></tr>
<tr><td>OR</td><td></td></tr>
<tr><td>ii. Explain in detail the steps involved in the general process of a GARCH model.</td><td>[05]</td></tr>
<tr><td>Q1 (b)</td><td>Prove that the time convolution theorem states that the convolution in time domain is equivalent to the multiplication of their spectrum in frequency domain.</td><td>[10]</td></tr>
<tr><td rowspan="3">Q2 (a)</td><td>i. Calculate the trend value by the least squares from the data given below and estimate the sales for the year 2012.
<table><tr><td>Year</td><td>2006</td><td>2007</td><td>2008</td><td>2009</td><td>2010</td></tr><tr><td>Sales of T.V. (in 000)</td><td>12</td><td>18</td><td>20</td><td>23</td><td>27</td></tr></table></td><td>[10]</td></tr>
<tr><td>OR</td><td></td></tr>
<tr><td>ii. What is trend? What are the various methods of fitting a straight line to a time series? Demonstrate the method of moving averages with the help of a suitable example.</td><td>[10]</td></tr>
<tr><td>Q2 (b)</td><td>Derive the equation for general time series data using infinite past with respect to forecasting ARIMA model.</td><td>[05]</td></tr>
<tr><td rowspan="3">Q3 (a)</td><td>i. Consider model, where $x_t = 25 + w_t + 0.6w_{t-1}$ where w_t is identically independent distribution. The coefficients are $\Theta_1=0.5$ and $\Theta_2=0.4$. Justify the following:
a) Which model does the equation best fits?
b) Values of autocorrelations.
c) Correlogram of ACF/PACF</td><td>[05]</td></tr>
<tr><td>OR</td><td></td></tr>
<tr><td>ii. Explain in detail the problem faced while modelling a time series data.
a) Derive the formula for Expected Value and Variance.
b) State the various values of $|\Phi|$with the help of appropriate graph stating the data is stationary or no.</td><td>[05]</td></tr>
</table>

Q3 (b)

i. Explain in detail the model used where differencing (1[st] differencing) is handled within the model if the data is not stationary and no seasonal component is present. Also, identify the model parameters and write the equation by analyzing the ACF and the PACF of the series as shown below (They start at lag 1). [10]





OR

ii. Apply an appropriate model based on the following parameters (also justify): [10]

a) (2,1,2) (3,1,3)4
b) (1,4)
c) ARCH (5)
d) GARCH (6,6)

Q4 (a)

i. Explain in detail the test used to determine whether the data is stationary or no. Demonstrate with the help of an example stating the stationarity of a time series data. [08]

OR

ii. Explain in detail the residual regression in time series with the help of an example. [08]

Q4 (b)

Calculate the seasonal indices for the rain fall (in mm) data in Tamil Nadu given below by simple average method for each season. [07]

Year	Season			
	I	II	III	IV
2001	118.4	260.0	379.4	70
2002	85.8	185.4	407.1	8.7
2003	129.8	336.5	403.1	12.0
2004	283.4	360.7	472.1	14.3
2005	231.7	308.5	828.8	15.9

Q5 (a)

Solve any two.

i. Explain in detail the model used where differencing (1st differencing) is handled within the model if the data is not stationary and the seasonal component is also present. [05]

ii. Explain a multivariate time series model with the help of an example and an equation. [05]

iii. Explain the suitable model used to identify, estimate and diagnose a best ARIMA time series model. [05]

iv. Explain the model which considers previous lagged values and past errors to forecast the future values with the help of an ACF and PACF plot. [05]

Q5 (b)

Explain the need of backshift/lag operator in time series analysis. Derive the generalized model for ARMA (3,3) using the backshift operator. [05]